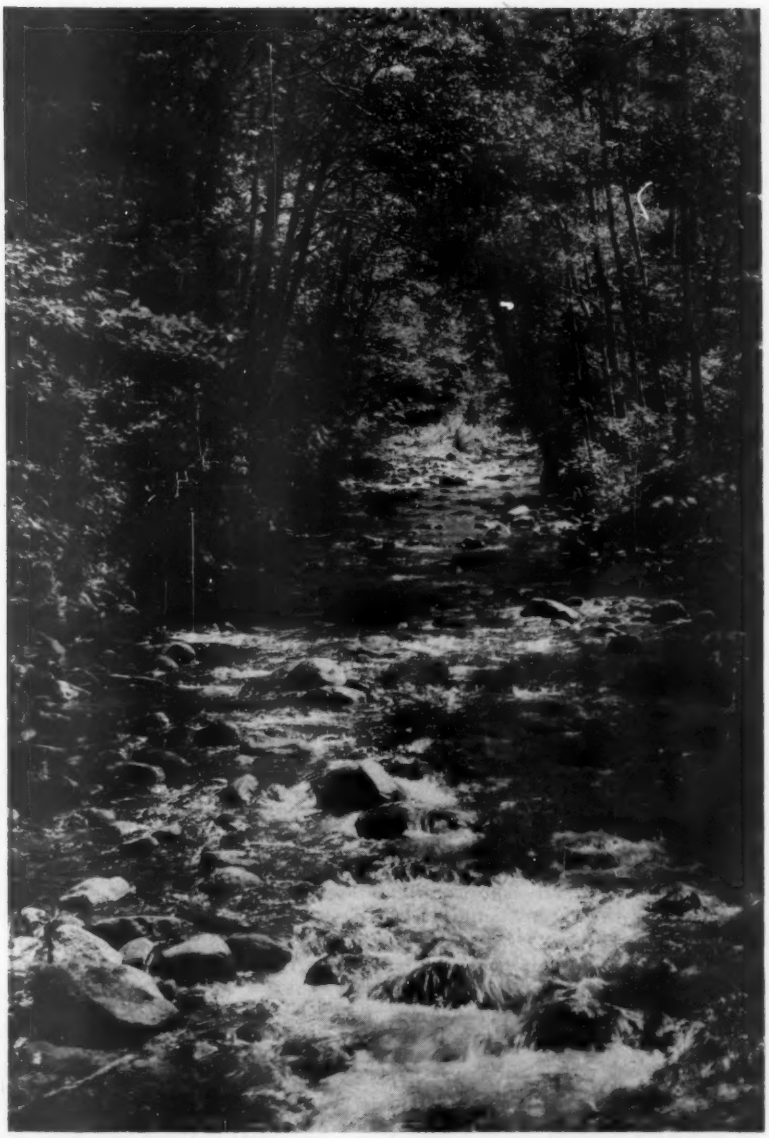
SEPTEMBER 1967
Vol. 33 No. 2

soil conservation

DEVOTED TO THE WISE USE OF LAND AND WATER RESOURCES



A LOOK AT WATER QUALITY

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SOIL CONSERVATION SERVICE

U. S. DEPARTMENT OF AGRICULTURE

September 1967 Vol. 33, No. 2

COVER: A clear running stream is evidence of good soil and water conservation practices on the watershed lands that contribute to its flow.

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DEVOTED TO THE WISE USE OF LAND AND WATER RESOURCES

Clean water . . . .

In this issue we begin an exploration of the relations of rural land management to the quality of the Nation's water supply.

The subject is part of our larger concern with the quality of the total human environment.

The problem: We begin with a researchers' review of the known facts, good and bad, about the problem. Dr. C. H. Wadleigh, ARS, appraises (p. 27) the sources of pollution from agricultural land. And Dr. Sam R. Hoover, ARS, sums up (p. 30) information about the land itself as a purification system.

The solution: Then we see some examples of positive action already under way to safeguard water quality.

SCS has helped food processing plants in the Northeast (p. 31) to dispose of effluent safely in fields and woods.

Recognizing sediment as a major pollutant, Hawaii has adopted (p. 33) a water-quality standard that recognizes soil conservation practices as the accepted means of compliance.

And three soil conservation districts in West Virginia have each selected a stream and begun a coordinated program to clean it up (p. 35).

This review clearly indicates that soil and water conservation itself is a major defense against water pollution from agricultural land.

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SOIL CONSERVATION is the official magazine of the Soil Conservation Service, published monthly by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business. The printing of the publication was approved by the Bureau of the Budget July 25, 1963.

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Subscription: $2.00 per year, $2.75 foreign. Single copy 20 cents. Discount of 25 percent on orders of 100 or more sent to same address. Order direct from Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

Can we keep it clean?

By C. H. Wadleigh
Director, Soil and Water Conservation Research Division, Agricultural Research Service, Beltsville, Md.

Agricultural Pollution of Water Resources

Agriculture is often accused, sometimes rightly, sometimes wrongly, of lowering the quality of lakes, streams, and rivers and even ground water with various kinds of pollutants.

The Senate Select Committee on National Water Resources in Committee Print No. 9 specifies eight general categories of water pollutants:

(1) Sediments.
(2) Sewage and other oxygen-demanding wastes.
(3) Plant nutrients.
(4) Infectious agents.
(5) Organic chemical exotics.
(6) Salts and mineral substances.
(7) Radioactive substances.
(8) Heat.

Although agricultural operations are not important to the last two categories, farming and the processing of farm products frequently do contribute to the other forms of pollution.

Agricutural pollutants are seldom discharged directly into streams, however, as often happens with effluents from industrial plants and municipal sewage systems. The unwanted substances originate, or are spread, widely on the land surface and are carried mainly in overland runoff to streams and lakes. With increasing demands for clean water, greater conservation efforts are needed to reduce this agricultural pollution.

1. *Sediments*

Sediments are the main burden of pollutants in surface waters. The Mississippi River delivers more than 500 million tons of sediment into the Gulf of Mexico during the average year. This amount is about one-half the average annual sediment delivered to the oceans by the rivers of the continental United States.

Carl Brown, formerly deputy administrator for watersheds, SCS, stated before the National Conference on Water Pollution that only about 1 ton in 4 of the silt produced by erosion ever reaches the ocean. The total sediment added to streams in the United States, then, must amount to about 4 billion tons a year. Agriculture is still losing a lot of soil, and a lot of water is being muddied. The Senate Select Committee report estimates that such suspended solids in the Nation's streams amount to at least 700 times the loadings caused by sewage discharge.

Aside from filling stream channels and reservoirs, suspended sediment makes necessary expensive treatment for municipal and industrial water supplies. Sediments impair oxidation of organic pollutants in streams. They cause erosion of power turbines, pumping equipment, and other structures. They reduce fish and shellfish populations by blanketing their nests, spawn, and food supplies.

The Potomac River, long known as a mud-carrying stream, drains 11,580 square miles in Maryland, Pennsylvania, West Virginia, Virginia, and the District of Columbia.

Studies on the Potomac Basin as a whole indicate gross soil erosion of about 50 million tons a year, and of that, sediment delivered into the Potomac estuary amounts to about 2½ million tons a year.

There is evidence, however, that activities outside of agriculture are responsible for major sediment deliveries into the Potomac. Suburban and industrial development is active on the outskirts of Washington, D.C. Bulldozers frequently remove all of the vegetation from hundreds of acres of land, and then the area is left idle for many months, or even years, until additional money becomes available for construction. The exposed subsoils in these suburban areas are extremely erodible, and there are

frequent erosive rainstorms. Some estimates indicate that 25 percent of the sediment coming into the lower estuary of the Potomac now arises from suburban construction sites.

2. *Organic wastes*

Sewage, animal wastes, and effluents from dairies, pea vineries, and canneries impair the quality of water mainly through their high biochemical oxygen demand.

Biochemical oxygen demand (BOD) refers to the amount of oxygen required to decompose the organic matter present in a sample of water. It is expressed by the amount of oxygen used when a sample of the water is incubated for a 5-day period at 68° F.

In such tests, samples not using more than 1 p.p.m. of oxygen in 5 days can generally be considered very pure, 3 p.p.m. used suggests fairly clean water, but water using 5 p.p.m. or more of oxygen is of doubtful purity.

It is not uncommon in a stream carrying appreciable wastes for the dissolved oxygen to drop down to 1 to 3 p.p.m. during the summertime. In the low flows of a sluggish stream during warm weather, there will be little oxygen available for either the respiratory needs of fish life or the oxidation of organic pollutants.

Untreated municipal sewage has a biochemical oxygen demand in the neighborhood of 100 to 400 p.p.m. Runoff carrying wastes from barnyards and feedlots may have a BOD varying from 100 to 1,500 p.p.m., depending on the dilution and degree of deterioration of the wastes. Wastes from vegetable canneries may vary in BOD from 100 to 10,000 p.p.m. A concentrated waste such as the juice from pea vine ensilage has been recorded as having a BOD of 75,000 p.p.m.

In evaluating the effects of farm wastes, we must keep in mind that most domestic animals daily produce fecal matter having greater biological oxygen demand than that of a man, although the BOD in relation to weight of effluent varies greatly among species. One cow, for example, will produce manure equal, in terms of BOD, to the sewage of 16.4 people. In studies at the National Institutes of Health, the following animal equivalents to human sewage production were determined.

Animal	Solid Waste Production	
	Gms/day	*Population equivalent*
Man	150	1.0
Cow	23,600	16.4
Pig	2,700	1.9
Sheep	1,130	2.45
Chicken	182	0.014

These data mean that a feedlot handling 1,000 head of cattle would have the same waste-disposal problem as a small city with a population of 16,400. The city would probably have sewage treatment facilities, but the feedlot is usually not so equipped.

We know from excellent studies at Pennsylvania State University that one of the best ways to purify polluted water is to let it percolate down through the soil. In fact, this is precisely the principle used in sand and charcoal filters in sewage treatment plants.

This suggests that areas where animals are concentrated should be provided with diversions so that runoff flows onto wooded or grass areas having high infiltration capacities. If contaminated runoff is prevented from reaching streams by overland flow, surface water supplies are protected. Normally, ground water is amply safeguarded by the filtering effect of the soil, although some soils, such as coarse sands or those that are shallow over fractured rock, do present problems of ground-water contamination.

Traditionally, the place for manure has been on the land. Recent attempts to dispose of it in lagoons have been unsatisfactory. Additional research is needed to develop more effective systems. Studies indicate that the benefits to soil fertility from manure application under modern farming conditions do not justify the cost of spreading.

But the livestock operator must contend with a daily supply of a product—manure—that he can't sell, can't give away, and can't burn. It is obvious that there is an urgent need to develop more economical ways and means of handling manure to provide some benefit to the land while eliminating possible pollution from farm runoff.

3. *Plant nutrients*

Complaints are rife that many rivers, ponds, lakes, and reservoirs are being ruined by the tremendous growth of algae and other water plants, forming what is known as "algal blooms." Not only are these "blooms" unsightly, but death and decay of the plants result in exceedingly unpleasant odors. Furthermore, the decaying plant life robs the water of its dissolved oxygen. The water becomes nearly uninhabitable for fish and unsavory for recreation.

These algae, like all plants, must have mineral nutrients in order to grow. In most waters the main limiting factor for algae growth is phosphorus, since other elements such as nitrogen, potassium, calcium, and magnesium are present in relatively abundant supply.

Available evidence indicates that these algae will grow vigorously if the water contains only 0.1 part per million of phosphorus. To completely inhibit algae growth the level of phosphorus in the water must be below 0.02 p.p.m.

The farmers of the United States apply millions of tons of fertilizers containing phosphorus on their farms, and some people may think that excessive phosphorus in surface waters is due to runoff from these fertilized fields.

But let us take a hard look at the sources of phosphorus.

We know that considerable phosphorus is present in domestic sewage from the use of detergents for washing. In fact, on the aver-

Sediment not only spoils recreational value but robs a lake of its capacity to store water for any purpose.

age, the amount of phosphorus delivered in metropolitan sewage effluent amounts to about 2 pounds per person per year. In other words, the sewage effluent from a city of 1 million people will contain 1,000 tons of phosphorus a year.

Phosphorus *is* getting into streams from farmland; however, it gets into surface water only through runoff and erosion of topsoil. Runoff from feedlots and barnyards that flows directly into stream channels may be a source of phosphorus. Barnyard waste usually carries about 1,000 p.p.m. of phosphorus. But we know that water seeping down through the subsoil or moving laterally through the soil carries little phosphorus.

Soil particles have a tremendous affinity for holding onto phosphate molecules. Even when the fine suspended particles in a river contain 1,000 p.p.m. of phosphorus adsorbed on their surfaces, the phosphorus in true solution may be only 0.005 to 0.010 p.p.m. Many water samples have been analyzed without making any distinction between phosphorus that was in true solution and that which was adsorbed on the suspended sediment.

We must conclude that the best way to control the phosphorus burden in streams that arises from agricultural practices is to use soil conservation practices and structures that minimize runoff and sediment delivery from fields and farmsteads.

4. *Infectious agents*

There is evidence from bacteriological studies on many of our otherwise attractive streams and lakes that they are never safe for swimming because of the prevalence of pathogenic bacteria. Some evidence indicates that most of the bacteriological pollution in a stream comes from farm runoff.

The presence of coliform bacteria in water has been used as an indicator of bacteriological pollution for about 75 years. Although the coliform bacteria are not pathological, their presence shows infectious bacteria might also be present.

Coliform bacteria can enter the water from animal wastes or from soil runoff, since some coliforms persist in soil. A trained technician with a microscope can distinguish between fecal coliform bacteria and those coming from soil.

Streptococcal bacteria are also normally present in fecal effluent. Studies indicate that in effluent from animal wastes, the ratio of coliform to streptococci bacteria is always less than 1 to 1 for such farm animals as pigs, turkeys, cows, chickens, sheep, and ducks. For human effluent, the ratio usually exceeds 4 to 1.

The magnitude of this ratio enables a bacteriologist to determine whether the bacterial pollution is coming from farms and farmyards or from urban centers. If the ratio is less than 1, the pollution is coming from nonhuman sources; if it exceeds 2.5, the bacterial pollution is coming from human sources. Values between 1.0 and 2.5 suggest that pollution is a mixture of human and nonhuman sources.

Such observations as we have indicate that the bacterial pollution of streams in some cases is derived from animal rather than human sources.

We need much more information on the undesirable bacteria in water. Veterinarians tell us that if spirochetes are present in water, there is a good chance that they were derived from wild animals, such as skunks and coons, creatures known to carry these infectious organisms and deliver them into the water into which they stroll. By contrast, our farm animal populations are comparatively healthy due to a relatively high level of veterinary supervision.

5. *Organic chemical exotics*

The Senate Select Committee on Water Resources states that organic chemical pollutants constitute "a water problem of great concern which will increase manifold in significance in the future . . ." Certainly, the headlines that we have seen about fish kills in the Mississippi River, and similar events, emphasize the great public concern over (agricultural) pesticides and herbicides as pollutants of surface waters.

Synthetic detergents, petroleum derivatives, and O-nitrochlorobenzine are some examples of organic chemical pollutants that may originate from industrial and metropolitan areas. There are also instances where pesticides found in rivers actually entered as effluent from industrial plants.

It is proper that the public should be very much concerned over possible poisoning of the environment. But water pollution from use of agricultural pesticides is not as extensive as some reports would lead us to believe. Leo G. K. Iverson, assistant director, Plant Pest Control Division in the Agricultural Research Service, recently presented a paper before the American Association for the Advancement of Science on "Monitoring of Pesticide Content in Water in Selected Areas." His findings indicate that even in areas where sizable quantities of chlorinated hydrocarbons have been used on large acreages, only traces of these pesticides were found in the runoff water.

For example, on a study area at Greenville, Miss., where endrin was used to control cotton pests, a total of approximately 22.5 pounds per acre was applied over a period of 9 years. Residues in the soil at the end of the period amounted to approximately 1 p.p.m. in the surface 3 inches, equivalent to 0.3 pound per acre or about the amount applied in a single application. Water from the area which had accumulated in a nearby slough was sampled on 19 different dates, and measurable residues were found on only six occasions, in amounts ranging from 0.07 to 1.49 parts per *billion*.

However, we must continue to be alert towards minimizing any potential dangers from the use of these chemicals.

6. *Salts and minerals*

Water moving through the soil picks up natural salts and minerals. Drainage from acid mine wastes is

(Continued on p. 40)

Disposal of waste on farmland

By Sam R. Hoover
Assistant deputy administrator, Nutrition, Consumer, and Industrial Use Research, Agricultural Research Service

Land with a good crop cover is a cheap, readymade oxidative system for the safe disposal of organic wastes such as remain after the usual treatment of effluent from food and fiber processing plants and from municipal sewage systems.

When such wastes are treated by aerobic or anaerobic processes to remove up to 90 percent of the biological oxygen demand (BOD), the effluent still contains some organic matter and usually nitrogen, potassium, phosphate, and other plant nutrients.

The idea of waste disposal on land with the concurrent growth of crops irrigated by the effluent is not new. It has long been practiced in Germany for sewage treatment and is currently practiced at several places in the United States.

Cheese whey and milk plant wastes have been sprayed on pasture successfully. A major frozen-food producer has sprayed effluent on crops and in woodland for many years. The rapid production of pine seedlings irrigated by paper mill effluents has had preliminary study and appears to be promising.

An acre of soil a foot deep has a volume of 43,560 cubic feet, of which roughly half is pore space that would be equivalent to a tank of about 1,600 gallons capacity. If the soil can be kept in an aerobic oxidative condition, it has a great capacity for absorption and microbial utilization of organic matter.

Recent studies of the disposal of treated municipal wastes at Pennsylvania State University by Dr. L. T. Kardos and associates are among the few research investigations of such systems. Here, an interdisciplinary approach is being taken in studies of the disposal of the effluent from a sewage treatment plant on agricultural and forest lands.

Chlorinated effluent was applied to corn, wheat, red clover, alfalfa, idle farmland, mixed hardwoods, and red pine plantations at rates of 1 and 2 inches per week through a revolving sprinkler irrigation system. Concentration of nitrate in the soil water below 12 inches was reduced 68 to 80 percent from that of the effluent applied to the plots; phosphorus, 99 percent; and detergent, 95 to 98 percent.

Nitrogen, phosphorus, and detergents are primarily responsible for the degradation of stream quality. It was estimated that, on plots receiving 2 inches of effluent per week, 1 million gallons per acre of high quality water was recharged to the ground-water reservoir for potential reuse during a 5½-month period.

As water reuse becomes increasingly important, requiring a higher degree of treatment and greater removal of plant nutrients than previously considered necessary, the economic value of *full* treatment of sewage and agricultural wastes will become more obvious. Final treatment through disposal on the land in many cases will have the additional value of water reclamation. ♦

Historical corner

George Washington made a survey and prepared statistics on agriculture in five States in response to a request from England. ♦

Soil cleanses waste water from food processing plants

Food processing companies in the Northeast are turning to fields and woods as a way to dispose of waste water from their plants without polluting local streams.

The soil and vegetation act as purifying agents when the water is sprayed on the land with irrigation sprinklers.

Various systems, planned with the help of the Soil Conservation Service, agricultural colleges, and others, have been used by the companies to screen and filter the water.

W. L. Wheatley Inc., of Clayton, Del., set aside 75 acres of its farm near its processing plant for use as a filtration medium to avoid pollution of nearby Providence Creek.

The water used in the processing plant—600,000 to 750,000 gallons a day in season—is spread over the 75 acres through ordinary irrigation pipes. Twenty-three lateral overhead pipes, containing 373 sprinkler heads, dispose of 650 to 750 gallons a minute.

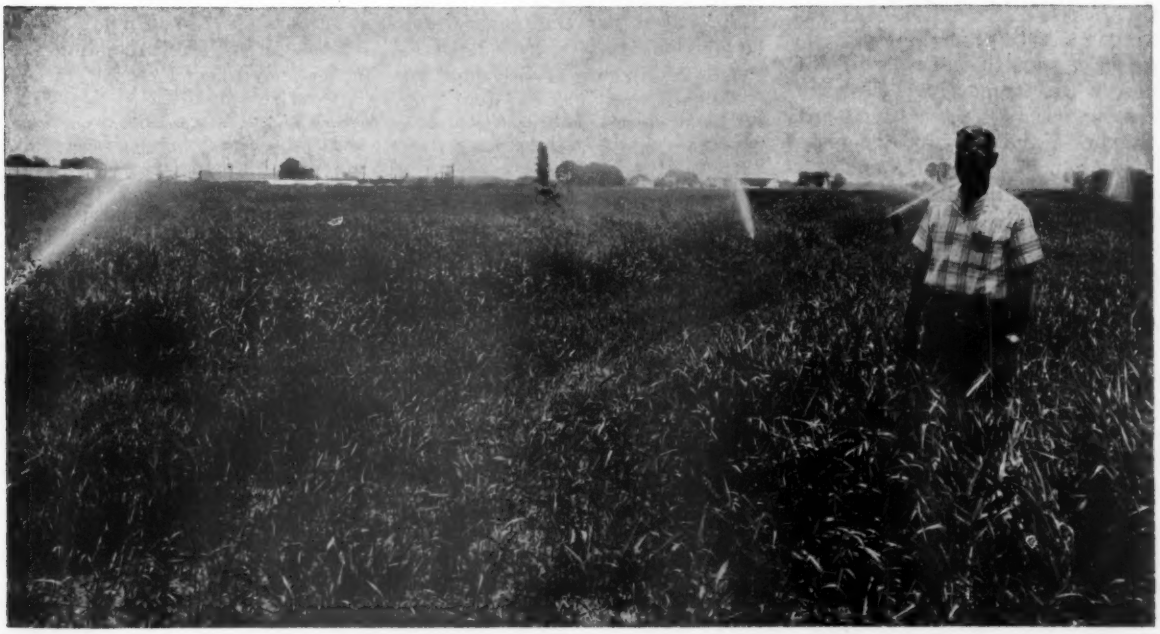
The company uses 30 to 34 sprinkler heads at a time. At the end of each hour, the water is automatically shifted to another set of laterals and their sprinklers.

Before entering the sprinkler system, the water is screened to remove the organic matter that accumulates as the vegetables are cleaned—corn shucks and silk, pea pods and other such waste material. The material is given to farmers for hog feed.

Besides the organic matter, the water leaving the plant contains chemicals used in processing the vegetables, including chlorinating fluids, detergents, and sodium salts. They make such a small percentage of the total volume of water that they do no noticeable harm to the organic matter or to the growing vegetation in the 75-acre filter field, according to Walter Ake, field manager.

As a soil conservation district cooperator, the company has had the help of SCS in preparing conservation plans for its several farms.

The filter field is planted to Kentucky 31 tall fescue, orchardgrass, and reed canarygrass. The soil had been kept in good condition by conservation practices, so



At peak operation, the Wheatley processing plant disposes of 600,000 to 750,000 gallons of waste water a day on its 75-acre filter field. John S. Richards, plant engineer, supervises the operation.

it is porous and permeable enough to absorb a large volume of water at a fast rate.

"After 3 years of operation, we see no ill effects, either to the soil or to the vegetation," Mr. Ake said. "The percolation rate has been maintained. We do not harvest the grass but mow it twice a year and let the grass remain on the land as a mulch. The waste water has had no bad effect on grass."

This effort to avert the pollution of Providence Creek was not accomplished without considerable expense. John Richards, plant engineer, says that the 75 acres of top quality farmland is valued at $800 an acre. The sprinkler equipment cost $55,000.

The Seabrook Farms Company, a large grower and processor of vegetables in southern New Jersey, sprays the waste water through large, rotating nozzles in a woodland. Here, too, the soil is the cleansing medium. As is usual in such operations, organic matter is screened out of the water before it enters the irrigation systems.

Before the system was installed a dozen or so years ago, Marco L. Markley, SCS soil scientist, classified the soils for the company and prepared soil profile descriptions to make sure that the area could absorb the large volume of water coming from the processing plant. Rutgers University faculty members also helped guide the company in setting up the disposal system.

P. J. Ritter Company, Bridgeton, N. J., also uses the soil and its vegetation to cleanse the water from its cannery. The proposed disposal site also was checked by Markley before the system was installed. As a result of his survey, the company altered its plans to avoid a subsurface layer of clay that would interfere with the passage of water.

At the Ritter place, too, Rutgers professionals helped in establishing the system and in making investigations of the site from time to time.

After 5 years of use, the soil of the Ritter site was found by R. B. Alderfer, professor of soils at Rutgers, to be better than at the start. The percolation rate continued high. Alderfer found a large increase in the number of earthworms in the soil. Presence of the earthworms, of course, has helped maintain or increase the rate of water absorption.

Other food processing companies are using the land to solve a pollution problem that only a few years ago seemed beyond practical solution. ♦

Centennial conservation field day

More than 350 Boy Scouts took part in the Nebraska Centennial Conservation Day held this spring at the Cornhusker Scout Reservation near Humboldt, Nebr. The event was sponsored by the Lincoln chapter, Soil Conservation Society of America, in cooperation with the Cornhusker Council, B.S.A.

Working in crews of 10 to 20, the boys put reed canarygrass and prairie cordgrass sod around the edges of their recreation lake, planted black walnut and hackberry trees, cut out undesirable brush and piled it for game shelters seeded reed canarygrass, and switchgrass in gullied areas throughout the reservation, and established a nature trail through their 80-acre woods.

A project like this generates a lot of community spirit. Leonard Pewther, director of program for the council, said 68 adults from 18 troop committees and 25 Soil Conservation Service people donated their services for the Conservation Day activities.

"After all, it's their camp," said one "boss man," Scoutmaster Rankin Carstens of Beatrice, who has 85 boys in his troop. "They come here every summer, and they feel a sense of ownership. It makes them feel good to do something to make the camp better."

The 800-acre Cornhusker Reservation formerly was in cropland and other farm uses. Henceforth, the rolling terrain will be devoted to just one crop—growing boys. A soil and water conservation plan has been developed by the council officers and executive staff with SCS help that will meet the needs of thousands of curious minds, restless hands, and roaming feet in the years to come. ♦

Boy Scouts spot-sod reed canarygrass along shoreline of lake at Cornhusker Reservation.

A soil conservation program approved by the conservation district is accepted as compliance by the landowner with the water-quality standard on sediment pollution.

Hawaii water-quality standards seek control of sediment pollution

By Francis C. H. Lum
Watershed planning staff leader, SCS, Honolulu, Hawaii

Sediment resulting from the erosion of building sites and agricultural land is recognized as a major form of water pollution, and soil conservation practices are specified as the accepted means of control, in water-quality standards adopted by the State of Hawaii and submitted to the Department of the Interior in conformance with the Water Quality Act of 1965.

Included in the proposed water-quality standards formally adopted by the Department of Health, the State-designated water pollution control agency, is the following "basic standard" applicable to all coastal water areas:

"6. Free from soil particles resulting from erosion on land involved in earthwork, such as the construction of public works, highways, subdivisions, recreational, commercial, or industrial developments, or the cultivation and management of agricultural lands. This standard shall be deemed met if it can be shown that the land on which the erosion occurred or is occurring is being managed in accordance with soil conservation practices acceptable to the Director of Health, and that a comprehensive conservation program is being actively pursued, or that the discharge has received the best practicable treatment or control or such lesser degrees of control as will provide for a water quality commensurate with the classified use of the water."

While the Department of Health as the responsible State agency will determine the adequacy of treatment, it will rely on the advice of soil and water conservation districts and the Soil Conservation Service as "expert" agencies with respect to soil conservation practices.

In Hawaii, possibly more than in any other State, most of the testimony in hearings preceding adoption of the standards focused on the problem of sediment pollution. Agricultural industry representatives were probably the most consistent participants in the 17 hearings conducted throughout the State.

Sediment pollution is spectacularly apparent in Hawaii when entire coastal waters become tinged after storms with the reddish hue of the Islands' volcanic soils. Most of the high-clay soils are relatively stable in their natural state but are easily eroded when cultivated. Because most of Hawaii's agriculture is located on the slopes of the predominantly mountainous islands, cultivated fields are easily seen as the major source of sediment pollution.

Charles T. Bourns, chief of Federal Water Pollution Control Administration activities in the State, says, "The worst pollution comes

Hawaii's hotels, concentrated along the shore, are vulnerable to sediment (above) swept from mountainside fields. The heavy rains cause severe rill and gully erosion on sugarcane and pineapple fields (below) that are not protected by conservation measures.

from storm water runoff eroding Hawaii's topsoil—from all over the Islands."

Not only the highly mechanized sugarcane and pineapple operations, but other earthwork activities are causing serious sediment problems. Building contracts, including development of subdivisions, industrial plants, and the necessary public works, have doubled in the past 10 years. In 1965, Honolulu ranked fifth nationally in the value of building contracts issued.

"Soil conservation is the principal program that can be applied to the control of sediments," says Bourns. "The procedure to minimize pollution from this source is to be assured that farmers have active conservation programs which have been developed in cooperation with soil and water conservation districts."

The standard will be implemented by requiring any person polluting waters of the State to abate the pollution within a specified time or be subject to fine or imprisonment, or both, upon conviction.

The city and county of Honolulu also recognizes that proper land treatment is the key to sediment control. For the past year, they have required subdivision developers to submit their plans to the Soil Conservation Service for review and recommendations as to means of curbing dust and erosion problems. Although such review is not required by city ordinance, the director of planning will not approve subdivision plans without SCS review. ♦

Know your soil

As an individual home buyer or builder, you may spend months checking and considering the design, materials, and construction of your new home. You should be equally concerned about the soil underneath. The soil you build on can seriously affect the stability of your home, your repair bills, your comfort, and the resale value of your property. ♦

Conservation districts pick streams for intensive cleanup campaign

By Thomas B. Evans
State conservationist, SCS, Indianapolis Ind. (formerly Morgantown W. Va.)

Three soil conservation districts in West Virginia have taken the initiative in a pilot effort to clean up polluted streams.

Supervisors of each district—the Elk, the Southern, and the Little Kanawha—have selected a stream within the boundaries of the district and set out to enlist the cooperation of public agencies and private interests to make it run crystal clear again.

Soil conservation districts, of course, do not have the authority or the capabilities within their own organization to do such a job alone. They are, however, in a favored position to focus the attention of responsible agencies and local individuals on the problem and coordinate their efforts.

The target streams

The three districts have wisely chosen to concentrate on small streams where there appeared to be reasonable opportunity for success. They are:

Big Ditch Creek in the Elk Soil Conservation District.

East River in the Southern Soil Conservation District.

Spring Creek in the Little Kanawha Soil Conservation District.

Supervisors of the Southern District hope to make the East River a year-round trout stream again. It used to be a natural trout stream, and there are still native trout in the upper reaches, although most of its length is now too badly polluted to support fish. Biologists from the State Department of Natural Resources and the Soil Conservation Service are jointly studying the problem.

Each of the three conservation districts is moving ahead in its own way, and all are getting definite action started toward cleaning up the selected streams.

They have made arrangements with the Federal Water Pollution Control Administration to study and report on existing conditions and what needs to be done. They have held meetings with the State Department of Natural Resources and State Department of Health, with such Federal agencies as the Farmers Home Administration, Office of Economic Development and Soil Conservation Service, and with various local interests.

Antipollution objectives

As the needs are pinpointed, each district will develop a plan of work to guide the cooperating organizations in carrying out their actions. The following is a combined list of their objectives:

(1) Building acceptable sewage disposal systems by several of the towns.

(2) Eliminating acid mine drainage from surface and deep mines in the affected watersheds.

(3) Installing basins at certain railroad yards to prevent diesel oil, detergents, and other industrial pollutants from entering the stream.

(4) Establishing a tertiary sewage effluent treatment plant for one of the cities concerned.

(5) Attacking pollution originating from filling stations, garages, and small industries located adjacent to the streams.

(6) Initiating a program for rebuilding private sanitation facilities that are contributing to the pollution of the streams.

(7) Eliminating siltation from unseeded roadbanks and other critical areas.

(8) Eliminating garbage disposal along the streambanks by a demonstration of sanitary landfill, under the provisions of the Solid Waste Disposal Act and the Appalachian Regional Development Act.

(9) Creating a single sanitary district for one of the watersheds, exclusive of the incorporated towns, or, as an alternative, establishing a separate sanitary district for each community.

In addition to the concentrated efforts in these three districts, all of West Virginia's soil conservation districts have executed Memorandums of Understanding with the State Department of Health for cooperation in the clean streams movement. Every one of the State's districts has updated its program and signed a revised Memorandum of Understanding with the Secretary of Agriculture and with a number of State departments and agencies.

The soil conservation districts of West Virginia are accepting the challenge to plan and develop the resources of the State for the future of the Nation. ♦

Districts self-governed

Each soil and water conservation district is legally responsible for soil and water conservation within its territory just as a county is responsible for roads or a school district for education. ♦

Hawaii's hotels, concentrated along the shore, are vulnerable to sediment (above) swept from mountainside fields. The heavy rains cause severe rill and gully erosion on sugarcane and pineapple fields (below) that are not protected by conservation measures.

from storm water runoff eroding Hawaii's topsoil—from all over the Islands."

Not only the highly mechanized sugarcane and pineapple operations, but other earthwork activities are causing serious sediment problems. Building contracts, including development of subdivisions, industrial plants, and the necessary public works, have doubled in the past 10 years. In 1965, Honolulu ranked fifth nationally in the value of building contracts issued.

"Soil conservation is the principal program that can be applied to the control of sediments," says Bourns. "The procedure to minimize pollution from this source is to be assured that farmers have active conservation programs which have been developed in cooperation with soil and water conservation districts."

The standard will be implemented by requiring any person polluting waters of the State to abate the pollution within a specified time or be subject to fine or imprisonment, or both, upon conviction.

The city and county of Honolulu also recognizes that proper land treatment is the key to sediment control. For the past year, they have required subdivision developers to submit their plans to the Soil Conservation Service for review and recommendations as to means of curbing dust and erosion problems. Although such review is not required by city ordinance, the director of planning will not approve subdivision plans without SCS review. ♦

Know your soil

As an individual home buyer or builder, you may spend months checking and considering the design, materials, and construction of your new home. You should be equally concerned about the soil underneath. The soil you build on can seriously affect the stability of your home, your repair bills, your comfort, and the resale value of your property. ♦

Conservation districts pick streams for intensive cleanup campaign

By Thomas B. Evans
State conservationist, SCS, Indianapolis Ind. (formerly Morgantown W. Va.)

Three soil conservation districts in West Virginia have taken the initiative in a pilot effort to clean up polluted streams.

Supervisors of each district—the Elk, the Southern, and the Little Kanawha—have selected a stream within the boundaries of the district and set out to enlist the cooperation of public agencies and private interests to make it run crystal clear again.

Soil conservation districts, of course, do not have the authority or the capabilities within their own organization to do such a job alone. They are, however, in a favored position to focus the attention of responsible agencies and local individuals on the problem and coordinate their efforts.

The target streams

The three districts have wisely chosen to concentrate on small streams where there appeared to be reasonable opportunity for success. They are:

Big Ditch Creek in the Elk Soil Conservation District.

East River in the Southern Soil Conservation District.

Spring Creek in the Little Kanawha Soil Conservation District.

Supervisors of the Southern District hope to make the East River a year-round trout stream again. It used to be a natural trout stream, and there are still native trout in the upper reaches, although most of its length is now too badly polluted to support fish. Biologists from the State Department of Natural Resources and the Soil Conservation Service are jointly studying the problem.

Each of the three conservation districts is moving ahead in its own way, and all are getting definite action started toward cleaning up the selected streams.

They have made arrangements with the Federal Water Pollution Control Administration to study and report on existing conditions and what needs to be done. They have held meetings with the State Department of Natural Resources and State Department of Health, with such Federal agencies as the Farmers Home Administration, Office of Economic Development and Soil Conservation Service, and with various local interests.

Antipollution objectives

As the needs are pinpointed, each district will develop a plan of work to guide the cooperating organizations in carrying out their actions. The following is a combined list of their objectives:

(1) Building acceptable sewage disposal systems by several of the towns.

(2) Eliminating acid mine drainage from surface and deep mines in the affected watersheds.

(3) Installing basins at certain railroad yards to prevent diesel oil, detergents, and other industrial pollutants from entering the stream.

(4) Establishing a tertiary sewage effluent treatment plant for one of the cities concerned.

(5) Attacking pollution originating from filling stations, garages, and small industries located adjacent to the streams.

(6) Initiating a program for rebuilding private sanitation facilities that are contributing to the pollution of the streams.

(7) Eliminating siltation from unseeded roadbanks and other critical areas.

(8) Eliminating garbage disposal along the streambanks by a demonstration of sanitary landfill, under the provisions of the Solid Waste Disposal Act and the Appalachian Regional Development Act.

(9) Creating a single sanitary district for one of the watersheds, exclusive of the incorporated towns, or, as an alternative, establishing a separate sanitary district for each community.

In addition to the concentrated efforts in these three districts, all of West Virginia's soil conservation districts have executed Memorandums of Understanding with the State Department of Health for cooperation in the clean streams movement. Every one of the State's districts has updated its program and signed a revised Memorandum of Understanding with the Secretary of Agriculture and with a number of State departments and agencies.

The soil conservation districts of West Virginia are accepting the challenge to plan and develop the resources of the State for the future of the Nation. ♦

Districts self-governed

Each soil and water conservation district is legally responsible for soil and water conservation within its territory just as a county is responsible for roads or a school district for education. ♦

The Secretary looks and listens

Secretary of Agriculture Orville L. Freeman, on his four-State "look and listen" tour this summer, got a firsthand view of soil and water conservation developments ranging from individual farms having well-established conservation plans to a million-acre Resource Conservation and Devvelopment Project.

The tour to check effectiveness of Federal programs in meeting the needs of rural people, particularly those in the lower income bracket, included areas of Iowa, Mississippi, Alabama, and Indiana.

The Secretary discussed problems with rural people, local officials, and Federal personnel to find out what needs to be done to build modern self-sufficient communities in rural America.

He was accompanied by Mrs. Freeman and representatives of the Bureau of the Budget, Office of Economic Opportunity, and Departments of Housing and Urban Development and Health, Education, and Welfare.

Tour stops of special interest to resource conservationists included:

—The Loren E. Eddy farm near Centerville, Iowa, where a conservation plan has substantially improved the farm's income potential.

—The Wayne L. Sample farm near Albia, Iowa, where SCS helped develop a recreation enterprise consisting of 80 campsites, picnic grounds, and water and sanitation facilities.

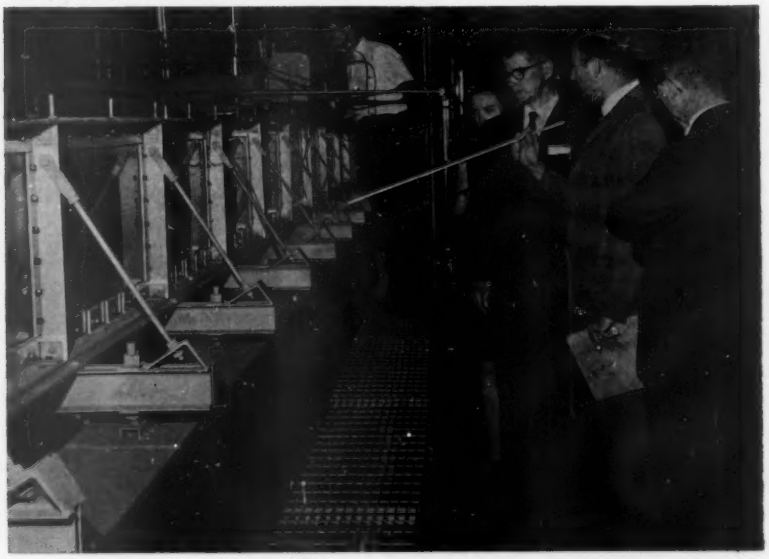
—The ARS Soil Sedimentation Laboratory and the SCS State Design Unit at Oxford, Miss.

—And the million-acre Lincoln Hills Resource Conservation and Development Project in southern Indiana, the first RC&D project approved by Secretary Freeman—in the operations stage for the past 3 years. ♦

Above, Secretary Freeman, with the help of Job Corpsmen Thomas Frazier and Earl Blank, chairman of the Lincoln Hills RC&D Project executive committee, officially opened the Saddle Lake Recreation Area in the Hoosier National Forest to the public. Then he and his party toured the facilities, including the Middle Fork of Anderson River Watershed Project. At right, he is flanked by James List, director of the Branchville Job Corps Conservation Center (left) and Al G. Dauby, chairman of the RC&D Forestry Committee.

At Demopolis, Ala. (below), Mrs. Orville Freeman took part in a beautification program by planting an evergreen magnolia tree on the grounds of Bluff Hall, a historic mansion built in 1882, now being restored. At the Loren Eddy farm near Centerville, Iowa (lower, center), Angus cattle caught the attention of Secretary Freeman. Eddy took over the all-but-abandoned 460-acre tract in 1956 and built it into a successful farming enterprise. Through his conservation farm plan he has installed 3,800 feet of diversion terraces, a farm pond, and 10 acres of grassed waterways. Eddy is a cooperator in the Appanoose Soil Conservation District and co-chairman of the Appanoose Watershed Association.

Secretary Freeman and his party (above, right) watch particle-board being manufactured at the Storrs Wood Products plant at Evanston, Ind., which will employ about 475 people when in full production. A Lincoln Hills RC&D Project measure, the plant was financed in part by Area Redevelopment Administration and Rural Electrification Administration loans. Dr. Amson Bertrand, ARS (below), explains to Secretary Freeman the research work being carried on at the Soil Sedimentation Laboratory near Oxford, Miss. The Secretary also toured the SCS State Design Unit where the research findings are put to practical use.



Raising fish is Kansas farm business

COOPERATOR Conley Cleveland is converting cropland, northwest of Republic, Kans., to production of golden shiner minnows and catfish.

A sportsman by instinct and training, Cleveland picked his production sites carefully. He leased a farm that has a high bluff above the river bottom. On the bluff are seven springs having a year-round flow of 300 gallons a minute of pure water at a constant temperature of 56 degrees.

Cleveland and the farmowner, George Powell, are cooperators with the Republic County Soil Conservation District. The Soil Conservation Service helped Cleveland plan his fish production enterprise. The soil survey indicated the suitability of the site for ponds.

He has completed 30 ponds, covering a combined area of about 30 acres. The depth of water is maintained at 3 to 4 feet. Each pond has its own inlet, a separate outlet, and is fed direct by springs.

In the spring of 1966, 3 ponds were stocked with 30,000 golden shiners, and 2 ponds with 36 five-pound channel catfish for propagation.

Cleveland produces minnows for bait, both retail and wholesale, and supplies catfish for the local markets.

Cleveland hopes to convert one tract of land into a pond covering 10 acres. He hopes eventually to expand his operations so he could contract with other farmers to stock their farm ponds with catfish. He would furnish the feed, give instructions for care of the fish, and harvest them annually. He would then pay the farmers for usable fish and restock the pond for a crop the following year.

Last spring, Cleveland had about 10,000 fingerlings and about 10,000 golden shiners ready for stocking farmer-owned ponds. This summer, he had more than 3,000 catfish for public fishing.

Conley Cleveland and Fred C. Gleue, SCS work unit conservationist, measure waterflow and temperature as spring water enters fish ponds. Cleveland's fish ponds in the Republican River Valley are supplied with water from springs in the nearby bluff.

His water temperature is suitable for trout. In July 1966, he stocked 8,000 trout, and the trout pond was opened in early April.

This kind of work is a drastic change from Conley's duties of a year ago, when he was a first lieutenant with the 77th Armored Fifth Infantry Division (mechanized) U. S. Army.—FRED C. GLEUE, *work unit conservationist, SCS, Belleville, Kans.* ♦

Good shelterbelts

Properly designed shelterbelts slow down speed of the wind by splitting air currents. Part of the wind is diffused through the belt, and part of it is diverted over the top. This creates an island of relatively calm air near the ground on the downwind, or leeward, side of the shelterbelt.

Watershed project and man of the year exemplify multiple community services

The 1967 Watershed of the Year—the North Fork Little River Watershed in Kentucky's Christian County Soil and Water Conservation District—is an example of the way in which watershed citizens solve their problems of flood hazards and water shortage and add richly to the quality of their environment.

As usual, the winning watershed was announced at the National Watershed Congress, held this year in Boston in June. Any one of the 12 other projects in competition for the 1967 award would have been a creditable selection, according to James B. Craig, editor of *American Forests* magazine and chairman of the awards committee.

The Watershed Man of the Year, William F. Vaughan, faced equally close competition. He lives in his ancestral home in Charlotte County, Va., and presides as chairman over the five-county Southside Soil and Water Conservation District. His friends say he is known as "Mr. Watershed" in recognition of his leadership in behalf of the Roanoke Creek Watershed Project, one of the first activated under the Watershed Protection and Flood Prevention Act.

The flood that didn't come

In the North Fork Little River watershed, residents speak of March 3, 1964, as the time the floods did not come.

They are remembering an earlier day, in 1957, when torrential rains fell in the area. Floodwaters swept through the area's principal city, Hopkinsville, leaving disaster that was reckoned at $610,000. At the intersection of Ninth and Main Streets, the water that day reached a depth of 4½ feet.

The rains in 1964 were as intense as at the time of the 1957 flood. But two of the proposed four floodwater-retarding structures were in place, receiving the runoff that would have meant repetition of the earlier damage. There was no damage in 1964.

And a billion gallons of water went into storage for domestic use.

The four structures in the project plan are now complete. Their combined 500 acres of water surface offers recreation opportunity for thousands.

A water treasury

The abundant supply of water provides for the foreseen needs of the community well beyond the year 2000.

The new water treasury has brought four new industries to the watershed, and three others are expanding because of the water-supply guarantee.

Local participation and cooperation were a key to the project success, as is inevitably the case in such achievements. The Little River Conservancy District, a project sponsor along with the Christian County Soil and Water Conservation District and the city of Hopkinsville, had no need to exercise its right of taxation and eminent domain. Land rights valued at $140,000 were secured from 65 landowners by the city. The city cost-shared more than $300,000 of the cost of the structures assigned to benefits other than flood prevention.

Landowners working through the Christian County District, with technical assistance from the Soil Conservation Service, have completed needed land treatment on well over four-fifths of the watershed's agricultural land.

The Kentucky Department of Fish and Wildlife helped with the fish and wildlife development, contributing $25,000. The U.S. Forest Service cooperated with the Kentucky Division of Forestry in the planting of 178,000 tree seedlings.

The Extension Service pushed

Lake Blythe, with an area of 90 acres when full, and its surroundings are being developed as a recreation area.

land treatment and helped with educational programs. The Agricultural Stabilization and Conservation Service helped with the planning and application work. The Army's Corps of Engineers provided hydrologic information and pooled their knowledge with SCS and local planners.

An area adjacent to Lake Blythe, one of the conservation and storage pools in the development, is being improved in the area's Youth Recreation Program. Girl Scouts have established a summer camp there.

During a period of drought last year, when a community not far away was forced to ration its water supply, the people of the North Fork Little River watershed were secure in their water abundance. Lake Boxley, from which the Hopkinsville water is taken directly, dropped only 26 inches during the long dry period.

New building, along the river, has taken a spurt since flooding is no longer a threat.

Man of long vision

The Watershed Man of the Year, Mr. Vaughan, whose farm is, according to conservationists, a splendid example of resource conservation, was one of the early believers in watershed planning for many uses and for long-range as well as the near-at-hand needs.

He pressed, in addition to flood prevention, for water for domestic supply and for industry, for supplemental irrigation, and for the development of the recreation potential in the area. He preached the value of land treatment and encouraged landowners to develop irrigation supplies as well as stockwater. There are 2,311 reservoirs holding irrigation water in the district and 1,879 farm ponds, nearly all stocked and managed for fish production.

Wetland preservation for wildlife has not been overlooked.

The entire area echoes a community's appreciation for work of Mr. Vaughan, wrote Mayor H. H. Hanmer, Jr., of Keysville, "With Mr. Vaughan's help we cooperated with the Soil Conservation Service to increase the height of the dam (Dam 70A on Spring Creek) which gives us around 200 acre-feet of available water. We now have a filter plant with a million gallons a day capacity which gives us an abundant supply of water now and provides for future growth. Prior to this we were pumping 13 wells and suffering an acute water shortage which made it necessary to close down our local industry at times." ♦

Water pollution

(Continued from p. 30)

an example of this type of pollutant. Salts in the wastes from certain industries is another example.

Rivers in arid and semiarid regions may pick appreciable quantities of salt from the land from which they flow. The Colorado River at Yuma, Ariz., carries more than 1 ton of dissolved salt per acre-foot of water. Samples of the Pecos River water in Texas during low flows have indicated concentrations of more than 15 tons of dissolved salt per acre-foot of water.

Salinity is a major problem in the irrigation agriculture of the Southwest. Samples of drainage from these irrigated lands have been found to contain up to 25 tons of salt per acre-foot of water.

Acid mine drainage, especially in the Ohio River Basin, has serious adverse effects on water quality and may destroy aquatic life.

It is clear that if pesticides, animal wastes, infectious agents, phosphate, or silt move from the land to our streams and result in water pollution, runoff and sediment delivery are the major vehicles. If we are to effectively reduce pollution from agricultural sources, soil conservation practices must be applied much more thoroughly and effectively to watershed lands than they are today. ♦

Tree-planting project reclaims surface mine

Boy Scouts from the Tri-Valley Scouting District took on tree planting as a project in helping to reclaim an old unbonded surface mine in Mineral County near Hartsmansville, W. Va.

More than 100 boys participated and planted 10,000 trees. The Potomac Valley Soil Conservation District provided a "patch" designed and made for this one project for each Scout and adult leader participating to wear on his uniform. The patch combined the Boy Scout gold seal and the district's seal with a tree to represent the planting project.

Several organizations cooperated. SCS developed a plan for planting the area and provided some of the adult leaders; the Department of Natural Resources gave the Potomac Valley District money to buy the trees; the district got the Boy Scouts to do the planting as a project; and the National Guard Unit prepared the food. ♦

Highway beautified

The Liberty County Girl Scout Troop with the help of former Texas Governor Price Daniel planted redbud trees for beautification on his land along State Highway 1011 last spring.

The redbud seedlings were furnished by the Lower Trinity Soil and Water Conservation District of Texas. Mr. Daniel, a strong backer of districts, is a cooperator with the Lower Trinity District. He runs a 5,304-acre cattle ranch and maintains a deer preserve on his land.—L. N. NEUMEYER, *work unit conservationist, SCS, Liberty, Tex.* ♦

Soil surveys beneficial to many

More than 50 million acres are surveyed each year by the 1,200 soil scientists employed by USDA. These studies are valuable not only to farmers, but to industry, highway engineers, land appraisers, and urban developers. ♦

Boy Scouts plant trees for beautification of school grounds

Get 400 Boy Scouts for tree planting and enlist the cooperation of the Izaak Walton League, the school district, and the soil conservation district, and the combination adds up to real accomplishment in beautification and conservation.

This was the experience in the Jefferson Soil Conservation District in Colorado where more than 4,000 trees were planted around 8 schools grounds and the county stadium 1 day in the spring of 1966.

The massive tree planting effort was the result of careful planning by Ken Fox of the Boy Scouts, Dale Jones of the Izaak Walton League, George McCormack of School District R-1, and specialists from the Soil Conservation Service.

Jefferson County, a growing suburban area west of Denver, has lots of kids, new homes, and new schools. School District R-1, with an annual budget of about $30 million, is big business in the county. It has 65 schools on about 1,750 acres of land that has conservation problems. Rains cause erosion, wind creates dust, the new schools look barren and lack privacy from other buildings and traffic.

School District R-1 applied to the Jefferson District for help in laying out tree plantings, grass seeding, diversion terraces, land leveling, and needed irrigation systems.

Tree planting for beautification was a major part of the plan—the Boy Scouts to supply labor and tools; the Izaak Walton League to furnish supervision; the school district to prepare the planting sites and supply the planting stock, watering facilities, and snow fencing for protection of the plantings. Planting stock was purchased from the Colorado State Forest Service Nursery at Fort Collins, Colo.

Specialists assisting the district drew up the plans and laid out the location for each tree, using a teaspoon of flour to mark the spot, since rain and wind don't destroy flour marks.

Every 3 boys had 1 adult supervisor, and 200 Boy Scouts worked in the morning and 200 fresh Scouts in the afternoon. Each group of 3 boys was given 30 trees to plant. Each boy dug 10 holes and planted and watered 10 trees.

After planting trees the boys reported to a new nursery set up by the school district to finish out their day, and 15,000 additional trees were lined out to provide a source of large planting stock for future years of beautification.

Boy Scouts working on merit badges in forestry and conservation received certificates for their work.

A recent inspection shows that almost 100 percent of the trees are growing well; the few replacements needed will come from the new nursery.

In a few short years all the school grounds in Jefferson County will be transformed, and conservation beautification will have been served by cooperation of Federal and local governments, private organizations, and people.—ELLIS LUND AND W. S. SWENSON, *work unit conservationist and woodland conservationist, SCS, Golden and Denver, Colo.* ♦

Some fellows are willing to work (left) but the tools just don't fit their size. Everybody had a job as Boy Scouts planted 4,000 trees in 1 day.

Gravel pit becomes a beauty spot

A gravel pit need not be a lasting blemish on the land.

Hugh Byrd of Sharon, Mass., proved that, on the contrary, with a little planning and imagination, the land could be left usable and attractive after gravel is removed for use and sale.

As a cooperator with the Norfolk Conservation District, Byrd had the help of the Soil Conservation Service in making a plan for the area before excavation began. He hired private surveyors to set the grades for him, then he checked on the contractors during the digging to be sure they excavated only to the depths specified.

"Before we started," Mr. Byrd said, "the land was so steep and irregular a goat couldn't get around on it—and now look at it." And looking at it now is easy on the eyes. The broad, gently sloping, grassed areas, dotted with native trees and shrubs, make it hard to believe what it used to be like.

"With the historic remains of the Boston-Providence Stage Coach Road running along one side of the area and the new Interstate 95 being put through on the other side, we wanted the public to have something attractive to look at."

After excavation was completed, he applied lime and fertilizer and seeded the area to grass. The Norfolk County Extension Service developed plans for landscaping the area with plant materials so as to give it a final touch of good looks. Large specimens of native trees and shrubs were transplanted so the site would eventually blend with the rest of the countryside.

People driving along Interstate 95 or walking along the Old Stage Coach Road will never know what the area might have looked like without Mr. Byrd's forethought—but they can be pleased with what they see because of it.—HENRY J. RITZER, *work unit conservationist, SCS, Walpole, Mass.* ◆

Scarred landscape, covered with ugly boulders (top), shows results of removal of gravel where no conservation measures have been taken to restore area. Another area (center) with possibilities for water-based recreation is an eyesore before conservation practices begin. Parklike effect (below) achieved by Hugh Byrd shows that gravel removal need not leave ugly scars.

Appalachian area farmers get special help

Low-income farmers in the McMinn County Soil Conservation District in Tennessee are making economic gains with stepped up assistance in conservation work following the designation of McMinn County under the Appalachia Regional Development Act of 1965.

To help with the acceleration of services to landowners in the district, SCS employed a local farmer, Warren D. Roseman, as a part-time conservation aide. Through his acquaintance with the people, and with the voluntary help of W. E. Nash, retired principal of Cook High School, Roseman was able to bring assistance to many farmers not reached before.

Since the district speeded up its program, SCS conservationists have helped all Negro farmers in McMinn County complete conservation plans for their land. Nineteen farm ponds have been built for livestock water, and 15 have been stocked with fish. Soil samples have been tested and fertilizer applied to crops on 24 farms. Several farmers are converting land to pasture.

One farmer is enlarging his dairy operation and building a new milking parlor. A community group is drawing up plans for a small slaughtering plant, a molasses sirup mill, and a community fence post treating plant.

Three elderly landowners have started raising rabbits and producing worms for fishing to increase their income.

The Piney Community has used $1,200 for a new well and water system for the church.

Two wells are providing some families with running water for the first time in their lives.

We and Area Conservationist Warren Corbett are quick to give credit to Roseman. When asked what he considered to be the most important thing to remember when working with disadvantaged farmers, Roseman replied:

"Discuss only one problem at a time. And, try to make that the one thing he is most interested in doing something about. After a problem and the solution are well understood, and plans are developed to solve it, you can move on to other items needing attention."

Other agencies have pitched in to help with the increased aid to disadvantaged landowners in McMinn County.

The county agricultural agent has held group meetings and provided other educational assistance. The County Agricultural Stabilization and Conservation Service has provided cost-share assistance on ponds and other practices. Farmers Home Administration made loans for installation of both wells.

Under the leadership of Rex Moses, chairman of the conservation district board and director of McMinn County Economic Development Office, adult education also is being provided to low-income people. A home and community beautification program is planned. A roadside market is planned in one community to help increase incomes.

Warren Roseman (right), soil conservation aide, looks on as Mrs. Frank Moore pours her son, Robert, a glass of water taken from a new well made possible by an FHA loan.

Roseman's assistance contributes greatly to these groups in helping to open the doors and minds of low-income farmers to the opportunities of increasing their incomes through resource development and conservation activities.—OBIE L. MASINGALE AND ELMER E. JONES, *assistant to State soil conservationist, SCS, Nashville, and work unit conservationist, SCS, Athens, Tenn.* ♦

Land resources interdependent

The several land resources—soil, water, plants, and animals—cannot be effectively used or managed separately. They are completely interdependent, and hence the land must be dealt with as a whole, acre by acre and unit by unit. ♦

Conservation work wins Hornaday Scout Award

A succession of conservation activities on the council campground and on a variety of other public areas in Massachusetts brought Boy Scout Troop 149 of Oxford the William T. Hornaday Award for distinguished service in conservation.

The award, presented by the Boy Scouts of America in cooperation with the New York Zoological Society, is reserved for a very few individual Scouts and Scout units that demonstrate exceptional accomplishment in conservation.

In 1965 and 1966, Troop 149 planted red pines, pruned and thinned existing stands, cleared fire trails and drainage ditches, treated gullies, and did other conservation chores while in camp at the Mohegan Council's Treasure Valley Training Reservation. The work was a part of the overall conservation plan for the 850-acre camp developed in cooperation with the Southern Worcester County Conservation District.

During the 2-year period 1965-66, the troop did similar chores in the Oxford town forest, at Hillcrest Farms in Auburn, at the Hodges Village dam and recreation area near Oxford, and at Camp Clara Barton, a summer youth camp for diabetic girls near North Oxford.—AUGUST I. REESE, *formerly work unit conservationist, SCS, and Scoutmaster of Troop 149, Oxford, Mass.* ♦

Low aerial photo flights reduce engineering costs

The Soil Conservation Service in Delaware is using aerial photography to reduce engineering survey work in woodlands in watershed project planning.

A new low level photo flight has been made on a small subwatershed to determine whether old drainage ditches and stream channels will show up through the trees. Where successful, the photos will make for fewer surveys for channel alinement and more effective use of the stereoscope for flood-plain delineation.

Delaware law permits the use of aerial photos for drainage-ditch land rights acquisition, provided the new channel location can be shown in relation to the present channel. Thus the same photos that reduce engineering survey costs will expedite land rights acquisition as well. ♦

Remote sensing of plants, animals, soils

Under a $246,000 contract let by USDA, scientists at Purdue University, Lafayette, Ind., plan to study ways to identify vegetation, animals, and soils by remote sensing equipment in satellites.

The study, sponsored by the Agricultural Research Service, is aimed at designing ways to correlate information gathered by remote sensing equipment for use in agricultural resource surveys.

Agricultural surveys by satellites equipped with optical and electronic sensors could, among other things, identify the world's agricultural resources and help underdeveloped countries in stepping up lagging food production and in developing natural resources.

Robert B. MacDonald is project leader for Purdue, and Dr. A. B. Park is technical representative for ARS. ♦

Help for pollution control

A Federal grant under Greenspan Program provides Sioux Falls, S. Dak., $19,932 to help buy 119 acres of cropland for expansion of its well field to prevent pollution of its water supply and provide sites for future wells.

Total cost of the cropland in the 160-acre farm is $39,865. The sum of $484 in cost-share assistance is also authorized to aid in establishing the conservation measures the land will need in its new use. ♦

Translations of research reports

Scientists in the Soil Conservation Service are helped to keep abreast of developments in their special fields by translations of foreign reports made under the Special Foreign Currency Science Information (SFCSI) Program administered by the National Science Foundation.

In the last 6 years, USDA has received nearly 800 translated articles in the earth and biological sciences. They are paid for by foreign currencies that accrue to the credit of the United States Government from the sale of surplus agricultural commodities.

Most translations have been of Russian literature, and the work was done in Israel. Some Polish and Yugoslavian articles have been translated and were done in Poland and Yugoslavia.

In 1967, translations from other European languages and from Arabic are to be started in Algeria, United Arab Republic, and India.

These translations include some important publications in soil science. Among the classics are Glinka's book, *A Treatise on Soil Science*; Dokuchaev's, *The Russian Chernozem;* and Gedroit's work on cation exchange reactions and their relationships to soil formation and behavior. The outstanding recent book in classification and genesis is *Soil Science* by Rode. These and other publications on soil and water conservation are listed below.

These translations, plus the cover-to-cover translation of *Pochvovedeniye,* the principal Russian soil periodical, into the English Journal, *Soviet Soil Science*, have enabled United States soil scientists, agronomists, and conservationists to obtain a better understanding of soil science and agronomy in the U. S. S. R. and other countries.

Most Land-Grant College libraries have copies of the translations.

Free distribution of those listed below has been made to SCS supervisory soil scientists and conservationists in each State.

Many of the publications are now available for purchase from the Clearinghouse, U.S. Department of Commerce, Springfield, Va. 22151. The "TT" number shown in the list of translations should be used in ordering a publication. The charge is $3 for each translation regardless of the number of pages.

The Soil Science Society of America now sponsors the *Soviet Soil Science*, 677 South Segoe Road, Madison, Wis. 53711. Copies are offered to a member of the Society at $9 a year where the library of the institution for which he works is a current subscriber to *Soviet Soil Science*.—ANTON J. VESSEL, *soil scientist, SCS, Hyattsville, Md.*

Soil genesis and classification

Treatise on Soil Science. By K. D. GLINKA. *(1931) 1963. 674 pp. Russian. TT 61-31002.*

The Place and Role of Contemporary Soil Science in Science and Life. By V. V. DOKUCHAEV. *(1949) 1966. 9 pp. Russian. TT 66-51117.*

Russian Steppes in the Past and in the Present. By V. V. DOKUCHAEV. *(1964) 1967. 67 pp. Russian. TT 66-51118.*

Study of the Zones of Nature. By V. V. DOKUCHAEV. *(1949) 1966. Russian. 13 pp. TT 66-51119.*

The Russian Chernozem (Selected Works.) By V. V. DOKUCHAEV. *(1948) 1967. 419 pp. Russian. TT 66-51133.*

Genetic Soil Classification Based on the Absorptive Soil Complex and Absorbed Soil Cations. By K. K. GEDROITS. *(1927) 1966. 70 pp. Russian. TT 66-51135/1.*

Selected Articles. By K.K. GEDROITS. *(1921-23, 1955) 1966. 75 pp. Russian. TT 66-51135/2.*

Short Course in Soil Science. By P. A. KOSSOVICH. *(1916) 1967. Russian. TT 67-51279.*

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Mechanical and Microaggregate Composition of Soils, Methods of Investigation. By N. A. KACHINSKII. *(1958) 1966. 134 pp. Russian. TT 66-51123.*

Guide Book for Determining the Lithologic Composition of Surface Deposits and Depth of Occurrence of Ground Waters. EDITED BY N. G. VEREISKII AND E. A. VOSTOKOVA. *(1963) 1966. 247 pp. Russian. TT 66-51134.*

Reclamation of Solonetz Soils of the USSR. EDITED BY I. V. TYURIN (ET AL). *(1953) 1967. Russian TT 67-51281.*

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Principles of Engineering Calculations for Loess Soils Deformation Under Irrigation Installations. By A. I. RUBENSHTEIN. *(1958) 1960. 11 pp. Russian. TT 60-21195.*

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Soils geography

The Soils of Southern Siberia (From the Urals to the Baikal). By K. P. GORHSENIN. *(1955) 1961. 758 pp. map in pocket. Russian. TT 60-21833.*

The Serozems of Central Asia. By A. N. ROZANOV. *(1951) 1961. 541 pp. Russian. TT 60-21834.*

Fundamentals of Soil Science and Soil Geography. By I. P. GERASIMOV AND M. A. GLAZOVSKAYA. *(1960) 1965. 382 pp. Russian. TT 65-50061.*

Soils of the Desert Zone of the USSR. By E. V. LOBOVA. *(1960) 1967. Russian. TT 67-51279.*

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Effect of Shelterbelts on the Soil of the Interstrip Area. By A. S. BAIKO. *(1955) 1960. 10 pp. Russian. TT 60-21896.*

Fixation of Sands by Means of Bituminous Emulsion. By N. N. BANASEVICH AND N. G. ZAKHAROV. *(1940) 1960. 5 pp. Russian. TT 60-21870.*

The Hydrological Role of Shelterbelts on the Kamennaya Steppe. By G. S. BASOV. *(1949) 1960. 20 pp. Russian. TT 60-21871.*

Soil Changes Under Shelterbelts in the Conditions of the Caspian Lowland. By A. P. BIRYUKOVA. *(1955) 1960. 9 pp. Russian. TT 60-21872.*

The Influence of Forest Belts on the Turbulent Exchange and the Optimal Width of the Belts. By M. I. YUDIN. *(1950) 1961. 4 pp. Russian. TT 60-21884.*

Shelterbelt, Kamyshin to Stalingrad. By A. GRACHEV. *(1957) 1960. 76 pp. Russian. TT 60-51079.*

Principles of Field-Protective Forestation. By B. I. LOGGINOV. *(1961) 1964. 302 pp. Russian. TT 64-11010.*

The Temparture Regime of Soils. By A. M. SHULGIN. *(1957) 1965. 218 pp. Russian. TT 65-50083.*

Soil Moisture and Its Significance in Agriculture. By S. A. VERIGO AND L. A. RAZUMOVA. *(1963) 1966. 234 pp. Russian. TT 66-51107.*

Welfare of downstream owners studied

The welfare of "the fellow downstream" is being studied in a huge watershed research project on the Washita River Basin of Oklahoma.

Because of growing interest in water conservation, many detention reservoirs, dams, and other water-control structures are being built in the Nation's major river bottoms. To find out if these structures threaten the water supplies of people further down the river, William O. Ree, hydraulic engineer, and his associates of the Agricultural Research Service of USDA installed an elaborate network of stream gages, rain gages, and sediment samplers on an 80-mile segment of the Washita River.

Findings to date indicate that, although the frequency of flood peaks has been lowered since the installation of detention reservoirs, the river still carries about the same amount of water during the year. ♦

Fieldbook. *2d. ed. 1967. Boy Scouts of America, New Brunswick, N. J. 565 pp., illus. $1.95.*

This fieldbook "for Boy Scouts, Explorers, Scouters, educators, outdoorsmen," is a lively companion for the official Boy Scout *Handbook.* It contains many how-to-do-it hints and bits of information that will help Scouts carry out the activities prescribed in the *Handbook* and help adult leaders and counsellors guide Scouts along the way.

The book is scarcely complete enough on any point to be a satisfactory reference for the person who needs explicit information. Its greatest value would seem to be in stimulating boys and men to try a wide range of outdoor activities which inevitably would lead them into learning situations. Even experienced outdoorsmen will find many useful facts and suggestions in this fascinating potpourri.—B.O.

New publications

Growing Loblolly and Shortleaf Pine in the Midsouth. By Charles X. Grano. *Rev. 1967. USDA Farmers' Bul. 2102. 27 pp., illus.* Information applies to loblolly and shortleaf pine lands in Arkansas, Oklahoma, Texas, Louisiana, Mississippi, Tennessee, and Alabama.

Lighting for Outdoor Recreation. *1967. U.S. Dept. Com., Business and Defense Services Administration. 26 pp., illus. $0.25.* Discussion of the extension of lighting facilities to existing recreational areas to make the best use of land in metropolitan areas, where it is at a premium; provide recreational facilities when and where working people are free to use them; and to reduce the cost of existing facilities per participant.

Municipal Watershed Management Symposium. Proceedings. Edited By John H. Noyes and Donald L. Madder *(1967) Univ. Mass., Coop. Ext. Serv. Publ. 446; Planning and Resource Development Series 4. Amherst. 84 pp., illus.*

"This symposium (held in 1965) attempts to bring together research and management information in three principal areas of concern to municipal watershed administrators having forest land management program responsibilities: (1) the role of the forest in quantity of water produced, (2) the effect of the forest on quality of water produced, and (3) the need for establishing forest land-use policy on both public and private municipal watersheds."

The Food We Eat. *1967. USDA Misc. Publ. 870. 15 pp. $0.10.* The story of the American farmer and food production in simple terms.

Rare and Endangered Fish and Wildlife of the United States. Compiled by Committee on Rare and Endangered Wildlife Species. *1966. U.S. Dept. Int. Bur. Sport Fisheries and Wildlife, Resources Publ. 34. Looseleaf.* A separate page describes the status of each species.

Trails for America. By Bureau of Outdoor Recreation. *1966. U. S. Dept. Int. 155 pp., illus. $2.25.* The report of a nationwide study made in response to the President's message on Natural Beauty in which he called for development of a system of trails for hiking, bicycling, and horseback riding. A system of cross-country trails along historic routes, supplemented by regional and metropolitan trails of scenic or historic values, is recommended.

Services Offered by the National Agricultural Library. Compiled by Robert B. Polend. *1966. 11 pp.*

Soil surveys

Parke County, Indiana. By H. P. Ulrich, A. L. Zachery, T. E. Barnes, P. T. Veale, Glenn H. Robinson, A. P. Bell, John Combes, S. D. Alfred, and Frank Sanders. *1967. 95 pp., illus.; maps 3.17 inches to the mile (1:20,000).*

Montgomery County, Pennsylvania. By Robert V. Smith. *187 pp., illus.; maps 4 inches to the mile (1:15,840).* Field survey by Robert V. Smith, Jack S. Levitan, Lester L. Seglin, Edward A. Tompkins, and John Zarichansky.

Kinney County, Texas. By Allen L. Newman, Jack W. Stevens, Tommie J. Holder, and Daniel Arriaga. *1967. 60 pp., illus.; maps 3.17 inches to the mile (1:20,000).*

Adams County, Pennsylvania. By Reginald Speir. *1967. 150 pp., illus.; maps 4 inches to the mile (1:15,840).* Soils surveyed by Reginald Speir, Robert G. Grubb, Richard S. Long, Donald C. Leer, John F. Meier, Richard Weaver, Max Coy, and Reginald P. Partenheimer.

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From the Administrator:

Clean Water from Farmland

Soil and water conservation practices are as important in assuring a clean and pure water supply as they are in preserving and improving soil resources.

Since a major part of domestic, municipal, and industrial water supplies originate as runoff from farm and forest land, the conservation measures and land-management practices that affect the movement of water over and through the soil are a major factor in water quality.

They are of especial significance at this time in relation to the water-quality standards that every State is now required to establish in response to the Water Quality Act of 1965.

Sediment pollution is one of the most serious problems of water quality. Recent estimates indicate that erosional debris accounts for a much larger part of the total burden of solids in the Nation's streams than do municipal and industrial sewage discharges.

Soil conservation practices obviously are the first measures of defense against sediment pollution. In many quarters, erosion control is considered more important as a means of protecting water supplies than for protecting soil resources. Good progress is being made in reduction of sediment from farmlands, but effective means are still needed to deal with critical erosion areas beyond the control of the individual landowner.

Lately new concerns have arisen over the quality of water coming from farmlands. Questions are being raised with growing frequency about the possibility of contamination by animal wastes from grazing lands and barnyards, the buildup of chemical residues from fertilizers and pesticides so necessary to efficient agricultural production, and the accumulation of organic wastes from the processing of food and fiber products.

These are valid questions and need to be faced squarely. They are a proper concern of soil conservationists who have a professional responsibility of helping land users manage their resources to achieve conservation objectives and create a wholesome environment for living.

The lead article in this magazine summarizes the facts as they are now understood about some of the principal sources of agricultural pollution of water supplies. As the article points out, the facts are not always as alarming as some of the fears that may be current.

But agricultural wastes, like those of any other human activity, do involve hazards to water quality if allowed to reach sources of supply.

Two principal courses of action appear open to safeguard against agricultural pollution of water supplies. One is to reduce, where possible, the quantity of contaminants produced or released. The other is to prevent these materials from reaching the water supply.

Soil conservationists can be helpful especially with the second phase of pollution abatement—the disposal and control of materials that must be released on the land. The Soil Conservation Service has had some experience in helping to plan irrigation systems to dispose of effluents from processing plants and sewage treatment systems. It has also been consulted in the design of sewage lagoons for animal wastes. The potentialities of these systems have scarcely begun to be explored, and the technologies of soil and water management are basic to their design and installation.

Besides such concentrated sources of pollutants as feed yards and processing plants, there is the problem of fertilizers and other chemicals, and of manure from grazing animals, that are dispersed widely over the land surface.

Soil conservation practices that minimize surface runoff of water are the best possible protection against such dispersed contaminants. It is in the overland flow that such materials reach streams and lakes from which water supplies are drawn. Complete conservation treatment of a watershed reduces surface runoff, causing much of the water to be absorbed into the soil before it reaches stream channels as base flow.

The soil, then, serves as a mammoth filter and purification system in which organic materials are oxidized and complex chemicals are broken down into simpler substances. Plant nutrients, especially nitrogen and phosphorus that stimulate unwanted algae growths in water, are held in the soil where they add to productivity for crops, pastures, or woodlands.

Adequate soil and water conservation treatment of all agricultural land, therefore, takes on new urgency as a major safeguard to water quality for the Nation. Conservation methods, no doubt, can be further refined to serve this objective, as they have been adapted to other changing purposes of land use in the past.

The technology of land and water use— the special field of proficiency of the soil conservationist —can serve our growing concern for the quality of our environment. We *can* have clean water from agricultural land.

D. A. Williams

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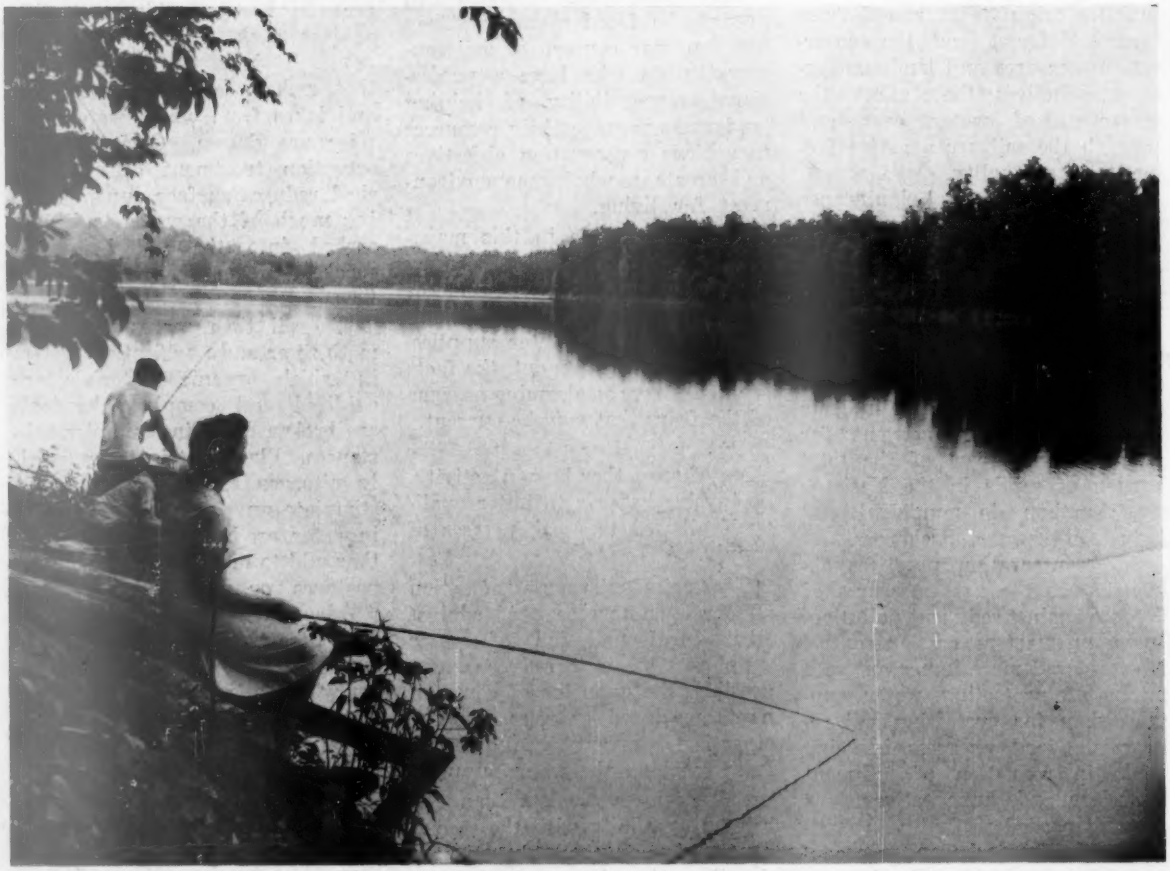
Winning watershed provides recreation

Story on page 39



The four lakes in the 1967 Watershed of the Year, North Fork Little River watershed of Kentucky, are providing an estimated 3,000 man-days a year of recreation, and use is increasing rapidly.

Fishing is available at all four lakes and boating at three of them.

The city of Hopkinsville has added a caretaker's home, sanitary facilities, and developed a picnic and camping area with tables and grills at Lake Blythe.

An area below the dam has been made available to the Cumberland River Girl Scout Council for a day camp. The council is negotiating for additional land adjoining the lake for a permanent Girl Scout camp. ♦